

AN IMPACT ON SUSTAINABLE DEVELOPMENT DUE TO RISE OF THE AUTOMATION AND ARTIFICIAL INTELLIGENCE

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ABSTRACT

The purpose of this paper is to understand the impact of increasing automation and artificial intelligence infused gadgets in the society and on the people. The research study mainly focuses on the job loss, increasing insecurities in the on-going jobs. The study recommends various steps to be taken for mitigation strategies and reduce the negative impact of automation on the society, like increasing the crime rate, Volatility and increasing instability in the market. It also focuses on the various methods which can be adopted for having artificial intelligence sustainable in the development of the society.

KEYWORDS: Automation, Sustainable Development, Artificial Intelligence, Mitigation Strategies, Job Loss & Job Security

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INTRODUCTION

The world today is witnessing an unparalleled growth of digital technologies, particularly in the fields of machine learning, communications, industrial automation and artificial intelligence. These buzzwords, collectively called “automation and AI” technologies for the purpose of this report, are fundamentally influencing the way humans work, interact with each-others (and with machines) and conduct themselves in the social environment. As it is true for the most of the changes, the adoption of these technologies brings with themselves both positive and negative impacts. There have been multiple academic research and journals on both the perspectives. The focus of this paper is to research on three topics specifically:

- Impact of digital technologies in industries, with particular lens on job-loss (and job-creation)
- Consequential impact of point 1 above, on the human society and social contract
- Ways and means to mitigate the negative impact of the automation and AI technologies on jobs and society

The famous economist John Maynard Keynes had once predicted job-loss and unemployment due to technology adoption. He had said job-loss would happen “due to our discovery of means of economizing the use of labour outrunning the pace at which we can find new uses for labour”. There have been multiple instances in which computers have replaced humans in jobs, particularly the ones that involve a large degree of repetitive work that can be codified. One of the most visible examples is ATMs replaced the bank-tellers. A report by the McKinsey Global Institute shows that since the financial crisis of 2008, over 44% of firms which had reduced their headcount

had done so through automation related changes (MGI, 2011).

The impact of these changes in the job structure is not limited to industries alone. They also affect the human society and social contract significantly. The earlier held belief since 1950s, propagated by Simon Kuznets (a Nobel Prize winning economist) had been that social inequality diminishes as countries become technologically advanced and more people benefit from the resulting opportunities. But Thomas Piketty, in his best-selling book “Capital in the 21st Century” contends that “the belief that technological progress will lead to the triumph of human capital over financial capital and real estate, capable managers over fat cat stockholders, and skill over nepotism is largely illusory.” Brynjolfsson identifies robots and automation among changes that are causing rising inequality. According to him, “the technology-driven economy greatly favours a small group of successful individuals by amplifying their talent and luck, and dramatically increasing their rewards”. He contends that there is a winner-take-all effect in the play here. A state of the art tax program replaces a tax consultant, Google replaces all search engines and the rewards accumulate with these winners rather than distributed more equitably among multiple competitors.

Data and statistics corroborate this – inequality is rising across the globe, particularly accelerating with the pace of technology adoption. The chart below, created by Tomas Hellenbrandt and Paolo Mauro (2015) shows how the global inequality has risen from 2003 to 2013.

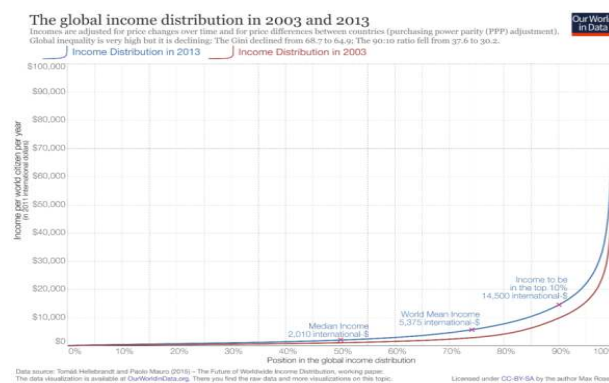


Figure 1: Growth of Global Inequality from 2003 - 2013

This report studies such changes in the society and consequent impact on the social behaviour in Part 2. In Part 3, the ways and means to mitigate such impacts are discussed.

History is replete with the examples of technological unemployment. The Industrial Revolution is a prime example – the spinning machines developed therein replaced millions of handloom workers. The advent of global trade and shipping along with it meant that the impact was felt hardest by the less developed societies. In the 20th century, the automobile manufacturers developed the concept of assembly line, significantly boosting the productivity, but resulting in a much lower labour-intensive production. Since the 1980s, a computer revolution has brought about similar changes. The cost of computing has been declining, while the power of computing has been rising exponentially. The impact of these changes on the society has also been profound. For example, adoption of computers has caused a fundamental shift in the job market structure.

Autor and Dorn (2013), contend that computers reduce wages in the routine tasks as computers gradually take them up. Instead, workers reallocate their efforts to either low-skill service applications or those having opportunities for higher education, into high job-skill occupations still protected from the realms of computers taking over. The job-market

in the US indeed reflects this change. Between 1980 and 2005, the changes in the US employment market were U-shaped – the highest and the lowest skill jobs expanded significantly and the mid-level jobs declined relatively. This polarization of labour-markets is not specific to the US, but is witnessed consistently in all developed economies. (Goos, et al., 2009).

LITERATURE REVIEW

Here first we will define the scope of the automation technologies considered for the purpose of this report. The framework for this has been defined by Autor et al. (2003) as a 2x2 matrix, with the degree of routines on one axis, and manual vs cognitive tasks on the other axis. Computers were historically employed for doing routine tasks, as these could be coded into explicit rules to be followed by the machines. Recently, with the advancement in the machine learning technologies, computers are also capable to perform non-routine tasks such as driving a car in traffic and comprehending natural human languages and handwriting.

Today the automation theme encompasses a wide scope of individual technologies. Prominent among them are:

- **Intelligent Robotics:** Robots are now able to do tasks that are not necessarily repetitive. Equipped with advanced sensors, visual and speech processing capabilities, these robots have enhanced cognitive capabilities that allow them to non-repetitive tasks such as collaborating with humans in dynamic environments, driving cars (autonomous vehicles). In 2015, it was estimated that there were 1.5 million robots globally. By 2025, the number is expected to explode to 25 million, according to a report by McKinsey¹¹. China is expected to lead this growth in robotics installation.
- **Additive Manufacturing:** Last few years have seen the adoption of additive manufacturing technologies in the multiple industries such as aerospace, automotive, medical products etc. enabling them to develop both prototypes and final products through sequential layering of materials. It is transforming the scale at which manufacturing business can be conducted – disrupting the economics of large-scale production and tilting the balance in favour of innovation and design. The global market for 3D printers is likely to reach \$ 5 billion by 2020².
- **Remote Connectivity and Cloud Technology:** Proliferation of data and communications technology has resulted in content and storage going to the cloud, thus making it possible to access and share data across users separated by geography. This has potential to shift the jobs away from the demand / production centres to low-cost centres at work can be delivered remotely over networks, thus boosting the jobs in the underdeveloped, yet skilled sections of the global economy. It is expected that 2020, almost 90% of the world's population will be connected through a mobile phone – greatly enhancing their ability to engage in productive activities remotely.
- **Big-Data and Advanced Analytics:** With the rise in the computing power, the size of database that can be processed has undergone exponential increase. It is now possible to analyze Tera-Bytes of data, including texts and images, which was hitherto not possible. Science is being used to identify the relationships and patterns at various steps in a manufacturing unit and optimizing them to maximize the output. Additionally, complex outputs such as weather systems, astronomical calculations, modern physics models etc. have become much more analyzable owing to this tremendous increase in computing abilities.

¹Auschwitzky et al., 2014

²McCue, 2012

- **Internet of Things:** As semiconductor based sensors are getting cheaper year on year, it is becoming increasingly viable to deploy them at almost every step in our business and social environment. All equipment, devices and machines of tomorrow will be connected to each other, continuously exchanging data and information over an omnipresent web of data network.
- **Machine-Learning Platforms, Visual and Speech Technologies:** A number of technologies such as deep learning, genetic algorithms, sparse dictionary learning, clustering, decision-tree learning, computer vision (augmented reality, virtual reality), natural learning process etc. are being developed that allows computer to operate and respond to a dynamic environment. The response of computers can be adapted to feedback from the surrounding, thus mimicking the non-deterministic response.

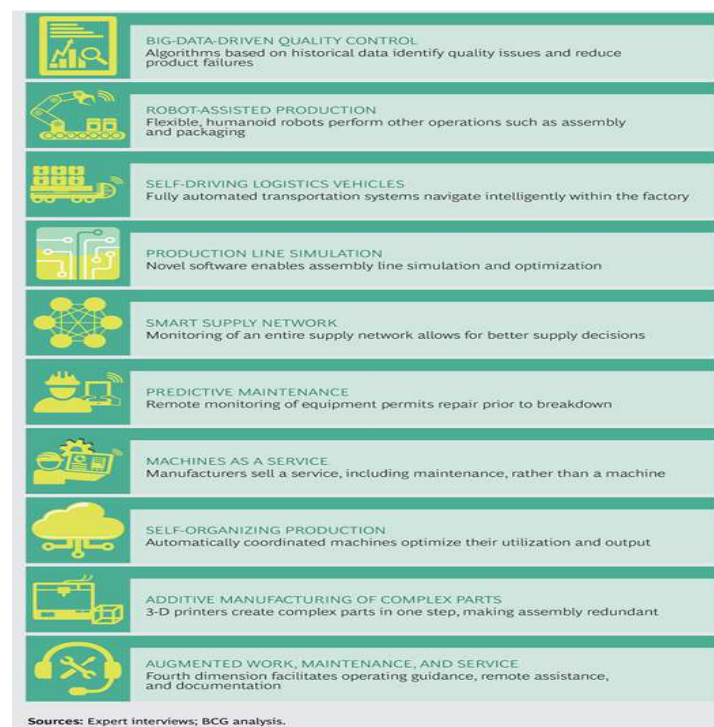


Figure 2: Scope of Industry 4.0 Technologies

Boston Consulting Group (BCG) has come up with a similar framework (Exhibit 1) for outlining the scope of automation on the industries. The umbrella of technologies under automation have been called “Industry 4.0”

Automation Impacts on Different Industries

(Price, 2017) It states that increasing automation has already taken many traditional and working and manufacturing class, but now is affecting the middle class too.

On 2016 February, a report (Price, 2017) by Citibank in partnership with the Oxford University, estimated that jobs the US risk d, to the UK automation in US is 47%, in UK it is by 35% the walls in China it is touching walls by 77% and all across by 57%.



Figure 3

And worlds' largest three are replacing their employees by robots.

(Price, 2017)³Mechanization will, "thus will quicken the as of now broadening financial disparity around the globe," Hawking composed. "The web and the stages that it influences conceivable to enable little gatherings of people to make gigantic benefits while utilizing not many individuals. This is unavoidable, it is encouraging, yet it is likewise socially damaging".

He outlines this monetary tension as a purpose behind the ascent in conservative, populist governmental issues in the West: "We are living in a universe of augmenting, not lessening, money related imbalance, in which numerous individuals can see not only their way of life, but rather their capacity to win a living by any means, vanishing. It is no big surprise then that they are hunting down another arrangement, which Trump and Brexit may have seemed to speak to".

Joined with different issues — overpopulation, environmental change, infection — we are, Hawking cautions inauspiciously, at "the most unsafe minute in the improvement of humankind". Humanity must meet up in the event that we are to beat these difficulties, he says.

(Price, 2017)Stephen Hawking has already communicated worries about man-made brainpower for an alternate reason, that it may overwhelm and supplant people. "The advancement of man-made brainpower could spell the end of humankind", he said in the late 2014. "It would take off without anyone else, and upgrade itself at a consistently expanding rate. People, who are constrained by moderate natural development, couldn't contend, and would be superseded."

Jobs Being Automated

(Tyson, 2017), stated that with growing automation it is going to impact quality and quantity of jobs too. Very latest Mckinsey research shows that there will be more replacement in future.

³ World Economic Forum (Price, 2017)

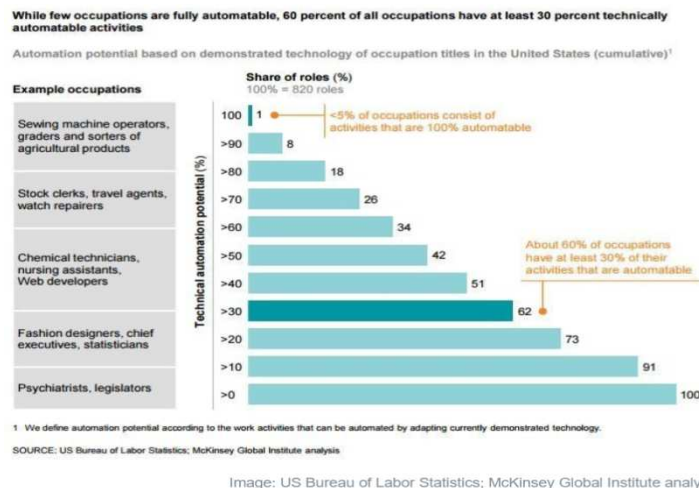


Figure 4: Percentage of Automation in Different Occupations

The examination, which incorporated 46 nations and 80% of the worldwide work constrain, found that a moderately couple of occupations – under 5% – could be completely robotized. Be that as it may, somewhere in the range of 60% of all occupations could have no less than 30% of their constitutive assignments or exercises computerized, in light of current showed advancements.

The exercises most defenseless to mechanization in the close term are standard subjective undertakings like information accumulation and information handling, and additionally routine manual and physical exercises in organized, unsurprising situations. Such exercises now represent 51% of US compensation, and are most pervasive in areas that utilize extensive quantities of specialists, including an inn and nourishment administrations, assembling, and retail exchange.

(Tyson, 2017)⁴. The McKinsey report additionally found a negative relationship between's assignments' wages and required ability levels from one perspective, and the potential for their robotization on the other. On adjust, mechanization diminishes interest for low-and center expertise work in bring down paying routine assignments, while expanding interest for high-aptitude, high-gaining work performing unique errands that require specialized and critical thinking abilities. Basically, mechanical change is ability one-sided.

RESEARCH METHODOLOGY

Research Design

The research design is exploratory design. This is because the exploratory research design does not aim to provide the final and conclusive answers to the research questions, but merely explores the research topic.

This research is conducted to see the impact of increasing automation on jobs and society overall.

Sample Size

The sample size contains of 100 respondents. The research contains the use of quantitative and qualitative methods. This Research will be conducted in the Delhi NCR area.

⁴ World Economic Forum

Data Collection Methods

The data needed to prepare this report has been collected through both primary and secondary sources.

Primary Data Source

Primary data will be collected through the structured questionnaire.

People focused here are the ones who have a minimum of 3 years of work experience and are in companies where processes are being automated.

Secondary Data Source

Secondary data will be collected through Books, Magazines, Articles, Newspapers, Journals & Websites.

The collected data will be further analyzed by using different statistical and analytical tools 'SPSS' and MS Excel.

Objectives

- To study the impact of Process Automation and Artificial Intelligence on jobs.
- To analyse the increasing impact of Automation and AI on society.
- To study the factors impacting most in jobs due to process automation AI.
- To help understand, the ways to mitigate the negative impact of automation.

Field Work

Got survey filled by people having a minimum of 3 years of experience, from various companies in Delhi NCR region like Genpact, Wipro, HCL etc

THE ANALYSIS

Impact of Automation On Job Loss and Society

The results are gathered from both primary and secondary data.

Automation Survey

In the Automation Survey majorly data is taken from IT industries in the NCR region. Also sample of people are majorly lying in the range of 5 to 15 years of experience and major income is in between 10 to 25 lakhs.

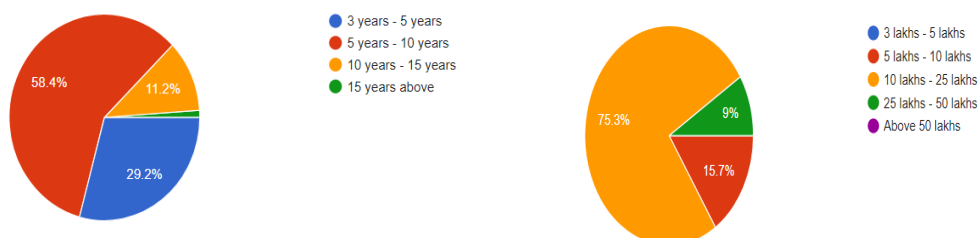


Figure 5: Years of Experience and Income Range

- The majority of the people think that automation is increasing. And the technology majorly taking over Indian offices are Big Data and Artificial Intelligence.

Is Automation of processes increasing in your company ?

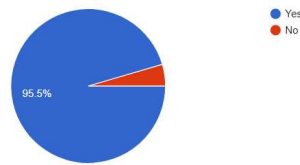


Figure 6: Automation Increase In Company

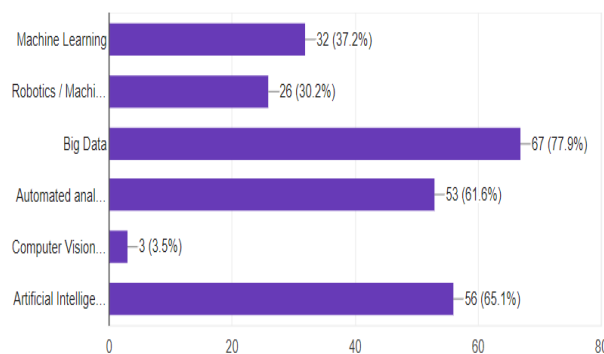


Figure 7: Different Methods of Automation

- From the survey, it is observed that with increasing automation, job loss, crime, physical and verbal communication and income gap has increased with time.
- Also from a survey it can be seen that contract employee and Support staff are most threatened as their jobs are repetitive in nature and can easily be replaced by automated processes.

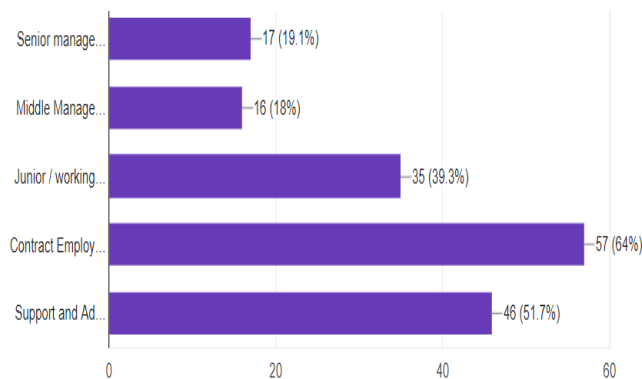


Figure 8: Automation impact at Different Designations

- Hypothesis testing is done
 - Null Hypothesis Ho:** There is no association between the increasing automation of processes in the company and increasing job loss in past 5-7 years.
 - Alternate Hypothesis Ha:** Assumes that there is an association between the increasing automation of processes in the company and increasing job loss in past 5-7 years.

On performing the Chi square test, the following results are obtained.

Table 1

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Present	N	Present	N	Present
Automation Increasing Job Loss Increasing	90	100.0%	0	0.0%	90	100.0%

Table 2

Automation Increasing and Job Loss Increasing Cross Tabulation					
			Job Loss Increasing		Total
			No	Yes	
Automation Increasing	No	Count	0	1	1
		Expected Count	.1	.9	1.10
		Count	3	1	4
		Expected Count	.5	3.5	4.0
	Yes	Count	9	76	85
		Expected Count	11.3	73.7	85.0
	Total	Count	12	78	90
		Expected Count	12.0	78.0	90.0

Table 3

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-Sided)
Pearson Chi-Square	13.872 ^a	2	0.001
Likelihood Ratio	8.754	2	0.013
N. of Valid Cases	90		

a. 4 Cell (66.7%) have Expected Count Less than 5.
The Minimum Expected Count is 13

From the above table it can be seen that the significance value of Chi square which is 0.001, which is less than the value of alpha which is 0.5 and therefore the Null Hypothesis (Ho) is rejected and Alternate Hypothesis(Ha) is accepted.

Thus we can say that there is an association between the increasing automation of processes in the company and increasing job loss in past 5-7 years.

- From Hypothesis Testing can conclude the following-
 - Automation and Job loss are associated, so it means with increasing Automated process with time there is going to be a greater job loss.
 - Also Job loss and crime are associated, so it means that with increase Job Loss people the crime in the city is going to increase as more the people lose jobs, they will have to take up other means to get money to their homes.
 - Automation and Income gap are associated, it means that with increasing automation the income gap between people is going to come among people, which will create more disparity in the society. People with required skills will be paid very much more as compare to the rest of the people, which can bring frustration in people and hence leading to more crime.

- Automation and less physical communication are associated. It shows how much today because of the increase in technology people communicate more virtually than actually communicating.

Data Analysis – Impact of Automation on Jobs

As we can see from the above results, the automation has huge impacts on jobs.

Availability of Jobs

As per a survey run by PricewaterhouseCoopers (PwC), more than 1/3rd of US manufacturers believe that automation technologies will create jobs related to advanced robotics and operating systems. However, it must be noted that the jobs getting created require high-skills, while those being replaced are fundamentally low-skill requirement jobs.

Thus, while the developed economies with their more skilled talent pool might be at an advantage to capture a larger share of the new jobs being created, the developing economies will certainly face a net job-loss as machines replace the entry-level roles. This is discussed in more detail in the next section.

Access to Jobs

This pattern of polarization has prompted worries about the conceivable effect of innovation on the two wages and quality employment. A few labourers would have occupations with higher wages (and have more elevated amounts of specialization and do numerous non-routine undertakings) while others may be negative affected through reduced wages. As one, more provocative, the rendering of this debate suggests, the world of work will polarize into “lovely” jobs and “lousy” jobs⁵.

Quality of Jobs

As a result of automation, job quality is expected to undergo an improvement since a lot of the jobs which exposed humans to health and professional hazards will be taken up by robots, thus making our factories safer and cleaner. However, this has a negative side too. Typically, people with limited career options and skill-set take up such hazardous jobs. It will be very difficult for them to find a replacement job once robots replace them.

Factors Influence on Jobs Due to Process Automation and AI

Factors that are being affected most due to automation today are –

Job satisfaction, Productivity, Performance, Job Security, Work Life Balance, Mental Health and Physical Health.

In **Factor analysis** it shows that the factor being affected the most is Job Security.

Table 4

Communalities		
	Initial	Extraction
Decrease in Job Satisfaction	1.000	.635
Decrease in Job Productivity	1.000	.637
Decrease in Job Performance	1.000	.633
Decrease in Job Security	1.000	.767
Decrease in Job Life balance	1.000	.737
Decrease in Job Mental Health	1.000	.662
Decrease in Job Physical Health	1.000	.639

Extraction Method: Principal Component Analysis.

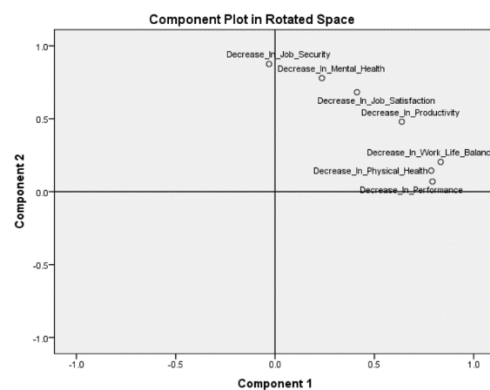


Figure 9

- Also from the basic questionnaire it showed that the factor being affected the most is Job Security.

Please rate the following factors in the ongoing job according to the impact of automation in your company. (1- Strongly Disagree, 2 - Mildly Disagree, 3- Undecided, 4- Mildly Agree, 5- Strongly Agree)



Figure 10 (a): Factors Impacting Jobs Due to Automation

⁵ Maarten Goos and Alan Manning, Lousy and Lovely Jobs: the Rising Polarization of Work in Britain, The Review of Economics and Statistics, MIT Press, vol. 89(1), pages 118-133, available at: <https://ideas.repec.org/a/tpr/restat/v89y2007i1p118-133.html>

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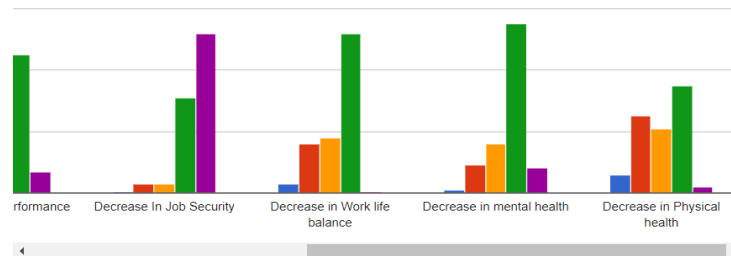


Figure 10 (b): Factors Influence on Jobs Due to Automation

- The data shows that people today in organizations are not getting security in jobs due to automation. Especially the roles which are repetitive in nature and can be easily be replaced by automated processes and AI.
- Also, secondary data shows, that in coming future ⁶automation can kill 73 million jobs by 2030. This was the latest report given by Mckinsey Global Institute.

Methods to Mitigate Negative Impacts of Process Automation

As the automation is on the rise, people who are low skilled or unskilled are at very risks of losing their jobs and being unemployed. Thus, here we have come up with a few solutions with our research.

Automation Survey

- With the help of survey it was found that a good set of experienced people feel that re training and upskilling can help people within the organization to grow with the changing need of time.
- The survey showed that many companies also provide such trainings to their employees.

Data Analysis: Other Methods

By secondary analysis, it shows that various other methods can also be taken to reduce the negative impacts of process automation-

- Provide people with universal basic pay, which can fulfil basic necessities like food, shelter, etc so that if people are not having jobs they have certain support from the government for their survival.
- The Earned Income Tax Credit should be redesigned so that refunds and credits can be given to the citizens every month.
- A separate account should be created, named as activity accounts, which can stay for an entire life. These accounts will help the people to learn all their lives and also help them in proving job retaining if it is needed.
- We should support and give certain incentives to people who go out of the way to volunteer in social work.
- We should encourage corporates to share profits for both type of people, ones who are working half time and

ones who are working full time. This cannot help people who have already lost the jobs, but can help those who are still working, but can lose their job due to automation.

- It's very important to change the academic curriculum of the students today. This is because today's students are being prepared to find good jobs, but in coming future that won't be the necessity, so better prepare them to create something new so that they are not threatened.
- We should encourage and support Art and Culture, as these are the areas where automation can't do much without humans, because being creative is a talent which only human holds.

CONCLUSION AND RECOMMENDATIONS

An Impact of Automation on Job Loss and Society

- With increasing automation, the income gap is increasing which should be worked on.
- Also with increase in technology, physical and verbal communication has reduced which are impacting the relationships at every level.
- As job loss is increasing, its seeping insecurity among people is also increasing, because of which crime has taken a hike. Job loss cannot be reduced immediately, but strict measures should be taken so that crime does not increase in the city and people feel safe.
- Measures should be taken to reduce the income gap among people, else it will bring disparity in the society.
- As low skilled jobs are the ones being replaced quickly, thus further training is required by the organization.
- With the increase in automation, quality of jobs is being jeopardized, which has to be taken care of, as they can also turn hazardous.

Factors that have an Impact on the Jobs Due to Process Automation and AI

- From the survey, it is clear that people are very insecure about their jobs, because among all the other factors, job security was rated the highest.
- Thus, companies should work towards employees to make them feel safe, otherwise being threatened all the time will reduce their productivity.

Methods to Mitigate Negative Impacts of Process Automation

- To mitigate the effects of automation, re- skilling trainings should be provided by the organizations.
- People losing jobs can run out of money so the universal payment method should be implemented and people can fulfil their basic necessities.
- Activity accounts can be created to have separate accounts for learning.
- We should provide incentives to those who participate in social work. We should change the style of education system and should promote more of innovative learning, as it will be required more in future.

⁶ USA Today

- More investments should be made in Art and Culture, as these fields cannot be replaced by automations.

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